

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-301268  
(43)Date of publication of application : 13.11.1998

(51)Int.Cl. G03F 7/004  
G03F 7/039  
H01L 21/027

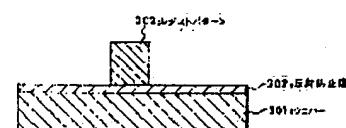
(21)Application number : **09-126278** (71)Applicant : **NEC CORP**  
(22)Date of filing : **30.04.1997** (72)Inventor : **ITANI TOSHIRO**

## (54) REFLECTION PREVENTING FILM MATERIAL

(57) Abstract:

**PROBLEM TO BE SOLVED:** To prevent contraction or trailing of a resist pattern on a reflection preventing film which is peculiar to a chemically amplifying resist, by adding one of or both of an acid compd. and a basic compd. to the antireflection film.

**SOLUTION:** An acid compd. or a basic compd., or both of these are added to a reflection preventing film material consisting of a crosslinking agent and a solvent, and the addition is controlled according to the acidity of a chemically amplifying resist to be used on the reflection preventing film, namely, according to the acidity of the acid produced from a photoacid producing agent. Thereby, the contraction and trailing of a resist pattern can be prevented. This is because the acidity is controlled to be almost same on the interface between the resist film 303 and the antireflection film 302 so that the deblocking reaction of the positive resist does not proceed on the interface between the resist film 303 and the reflection preventing film 302. Moreover, no excess changes in the compsn. is required to the resist material, the gradient of solubility characteristics which largely influence the resist resolution can be maintained large, and higher resolution can be obtnd.



## LEGAL STATUS

[Date of request for examination] 30.04.1997

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3031287

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of

[Date of extinction of right]

[Date of extinction or right] 18.07.2001

Copyright (C) 1998,2000 Japan Patent Office

\* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

## DETAILED DESCRIPTION

---

### [Detailed Description of the Invention]

#### [0001]

[The technical field to which invention belongs] Especially this invention is exposed about the material for antireflection films through the mask or reticle describing the semiconductor integrated circuit pattern of a request of the chemistry multiplier system resist formed on the semiconductor substrate, and relates to the ground antireflection film material used in case negatives are developed using a developer and a photoresist pattern is formed after PEB processing.

#### [0002]

[Description of the Prior Art] In the conventional optical lithography, it was what used g line (436nm) and i line (365nm) for the exposure light, and the dissolution suppression type positive resist which used the novolak resin for the base resin and used naphthoquinonediazide for the sensitization agent as the resist was in use.

[0003] However, it was the situation that the lithography using the excimer laser light (248nm, 193 etc.nm, etc.) which is far-ultraviolet light more advantageous to detailed-izing is needed, an optical absorption was too large, and a good resist pattern was not obtained by the conventional g line and the resist for i lines as the resist with detailed-izing of the latest semiconductor device, and sensitivity also increased sharply.

[0004] The chemistry multiplier system resist using the sensitization reaction of the acid catalyst generated from a photo-oxide generating agent is originated to such a problem, and it is becoming in use as the resist for short wavelength lithography, and a resist for electron beam lithography as which high sensitivity is required. this chemistry multiplier system resist (chemically amplified resist) is a resist by which induction of the catalytic reaction is carried out and insolubilization (negative mold) or solubilization (positive type) is promoted to a developer in continuing heat treatment (post -- exposure BEKU-EB) with the acid generated in exposure including the acid generator as a sensitization agent in a resist

[0005] The feature of a chemistry multiplier system resist is using the resin with very high transparency, by this, the influence of the reflected light from a ground substrate became large to the lithography using the conventional g line and the resist for i lines, and its need of using an antireflection film (it also being called anti-reflectivecoating;ARC) has increased.

[0006] Although the organic system antireflection film which consists of a cross linking agent and a solvent has been used in the conventional g line and an i line lithography as an antireflection film, also in KrF excimer laser lithography, this has been used continuously.

[0007] This organic system antireflection film had the trouble when the acidity of a resist is high, that skirt length of the resist pattern 603 arose as a chemistry multiplier system resist is a positive type, and it is shown in drawing 2 to the acidity of an antireflection film, and the vena contracta arises to the resist pattern 503 and the acidity of a resist shows a low case at drawing 3, when membranous acidity was not controlled but it used as a ground of a chemistry multiplier system resist.

[0008] The method which some methods are proposed from before as a method for aiming at solution of this problem, for example, adds an acid or a base to the chemistry multiplier system resist itself is learned (for example, refer to the publication of JP,7-72628,A).

#### [0009]

[Problem(s) to be Solved by the Invention] However, by the method of adding an acid or a base to the above-mentioned conventional chemistry multiplier system resist itself, although the vena contracta of the resist pattern on an antireflection film and skirt length are cancelable, the inclination of the steepest place of the light exposure dependency of the dissolution property over the developer of a resist and the dissolution property of affecting a definition most especially becomes small.

[0010] This is equivalent to a definition deteriorating and means that there is a trouble it not only cannot demonstrate an original resist performance, but that a dimensional accuracy deteriorates in connection with dissolution contrast falling.

[0011] Especially the definition of the photoresist pattern which originates in degradation of such a dissolution-rate property to detailed pattern formation and degradation of a dimensional accuracy are fatal.

[0012] As mentioned above, the antireflection film material itself needs to be improved.

[0013] Therefore, it is originated in view of the above-mentioned technical problem, and this invention has the purpose in offering the vena contracta of the resist pattern on an antireflection film peculiar to a chemistry multiplier system resist, and the antireflection film material which cancels skirt length.

[0014] Moreover, this invention can obtain a rectangle resist pattern, improves a definition and a dimensional accuracy, and aims at offering the antireflection film material which enables high integration of a device pattern while it attains the

above-mentioned purpose.

[0015]

[Means for Solving the Problem] In order to attain the aforementioned purpose, antireflection film material of this invention is characterized by the thing it comes to add either an acid compound or the basic compounds, and both in the antireflection film material which contains a cross linking agent and a solvent at least.

[0016]

[Embodiments of the Invention] The form of operation of this invention is explained below. In the antireflection film material in which the antireflection film material of this invention contains a cross linking agent and a solvent at least in the form of the desirable operation, it comes to add an acid compound, a basic compound, or both.

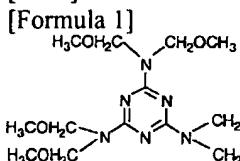
[0017] Thus, in the form of operation of this invention, by adding according to the acidity of the chemistry multiplier system resist which uses an acid compound, basic compounds, or these both on an antireflection film, i.e., the acidity of the acid generated from a photo-oxide generating agent, into the antireflection film material which consists of a cross linking agent and a solvent, a resist pattern is narrow and a bird clapper can be prevented in a skirt length configuration. Acidity becomes almost the same by the interface of a resist film and an antireflection film, and this is for not going on by the deprotection reaction of a positive resist being the interface of a resist film and an antireflection film.

[0018] Moreover, since resist material is not forced an excessive composition change consequently, the inclination of the dissolution property of affecting resist resolution most can be kept large, and high resolution-ization is attained.

[0019]

[Example] The form of operation of the above-mentioned this invention is explained below with reference to a drawing about the example of this invention that \*\*\*\*\* explanation of the more concrete example should be given. In one example of this invention, antireflection film material consists of a cross linking agent (hexamethoxy methyl melamine) and a solvent (Propylene Glycol Monomethyl Ether Acetate, propylene-glycol-monomethyl-ether acetate-GMEA), as shown below.

[0020]



架橋剤

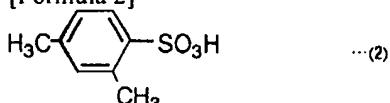


溶剤

[0021] The benzenesulfonic acid shown in this as a chemical formula 2 below is added.

[0022]

[Formula 2]



[0023] For example, by adding a benzenesulfonic acid ratio 5% of the weight for a cross linking agent, when 2 component chemistry amplification resist which consists of polyhydroxy styrene resin which has a t-BOC (t-butoxycarbonyl) machine in a protective group, and a photo-oxide generating agent is used, as shown in drawing 1 as drawing of longitudinal section, the rectangle resist pattern 303 can be obtained.

[0024] Acidity becomes almost the same, this is the interface of a resist film and an antireflection film, and it is [ the deprotection reaction of a positive resist is the interface of a resist film and an antireflection film, and ] for not going on.

[0025] Although an effect with the same said of a negative resist is acquired, it originates in the crosslinking reaction of a negative resist not advancing by the interface of a resist film and an antireflection film in this case.

[0026] Moreover, as an example of the base to add, N-methyl pyrrolidone shown as a chemical formula 3 is listed to below.

[0027]

[Formula 3]



[0028] Depending on the kind of resist, the acidity of an antireflection film is high and the vena contracta arises to a resist pattern. In such a case, a rectangle resist pattern can be obtained by adding a basic compound.

[0029] an acid compound and a basic compound -- when adding any, in accordance with the acidity of the resist material used on an antireflection film, and the acid especially generated from a photo-oxide generating agent, it is necessary to choose the kind and an addition moderately In any case, about 10 % of the weight is [ an addition ] desirable from the ratio 1 for a cross linking agent.

[0030] Thus, according to this example, since a rectangular resist pattern is obtained, a dimensional accuracy can be raised. Specifically, the definition and the dimensional accuracy were able to aim at improvement in 10% or more.

[0031] In addition, in this invention, the kind of compound to add is not limited to what was shown in the above-mentioned chemical formulas 2 and 3 as an example in an antireflection film that what is necessary is just to demonstrate acidity or base.

[0032]

[Effect of the Invention] As explained above, the resist pattern of a chemistry multiplier system resist which is used on it according to the antireflection film material of this invention is narrow, a bird clapper is prevented in a skirt length configuration, and the effect that the definition of resist original can be demonstrated is done so.

[0033] Moreover, according to this invention, by choosing the acid to add, the kind of base, and an addition suitably, the resist pattern configuration on an antireflection film can be controlled, and a definition can be raised.

[0034] Furthermore, according to this invention, since a rectangular resist pattern is obtained, the effect that a definition and a dimensional accuracy can be raised is done so. Especially to detailed pattern formation, the effect is large and can form a rectangular photoresist pattern with sufficient repeatability.

---

[Translation done.]

\* NOTICES \*

**Japan Patent Office is not responsible for any damages caused by the use of this translation.**

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**CLAIMS**

---

[Claim(s)]

[Claim 1] Antireflection film material characterized by the thing it comes to add either an acid compound or the basic compounds, and both in the antireflection film material which contains a cross linking agent and a solvent at least.

[Claim 2] Antireflection film material to which the addition of the acid compound to add or a basic compound is characterized by being 10 % of the weight from the ratio 1 for a cross linking agent in an antireflection film material according to claim 1.

[Claim 3] Antireflection film material characterized by using the aforementioned antireflection film material according to claim 1 or 2 in a chemistry multiplier system resist.

---

[Translation done.]